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AGRICULTURAL MEMORANDUM Number 909

A TEST OF THE GRAINGER HYPOTHESIS USING A COMPUTER MODEL OF POTATO BLIGHT DEVELOPMENT

1. INTRODUCTION

A computer model for relating the progress of potato blight to weather has been described by Sparks (2). The model assumes that the potato plant is equally susceptible to infection for similar microclimatic conditions throughout the growing season. Grainger (1) argues that the plant is less prone to infection in the middle stages of development when the ratio of total carbohydrate in the whole plant to the carbohydrate-free dry weight of the shoot (Cp/Rs) is less than unity. This change in susceptibility has been programmed into a version of the model and results compared with those from the standard version.

2. BACKGROUND CONDITIONS FOR THE MODEL RUNS

Since the object of the exercise was to isolate the effect of theoretical changes in susceptibility on the development of potato blight all other factors such as the level of inoculum and the rate of haulm development were assumed to be the same in all years. It was assumed that the crop met within the rows on 13 June, across the rows on 1 July and that the haulm was fully developed by 19 July. The susceptibility of the plant was simulated by varying the ratio of infections to the number of viable spores released. This ratio was made dependent on the Cp/Rs ratio. Graingers Cp/Rs ratio for 1950 and 1954 and the power functions used in the model for all years are shown in fig 1.

3. RESULTS

Using the same weather data for both series of comparisons the program was run for the years 1958-70 for Waddington and the calculated value of $\log_e$ (lesions) was noted on the mean outbreak date each year. These numbers were averaged for the 12 years with reported outbreaks to give a critical outbreak value for each version of the model. The procedure was then reversed and the day on which the calculated $\log_e$ (lesion) reached the average was taken as the predicted date of outbreak for that year.

TABLE 1 - MODEL RESULTS

YEAR	OBSERVED DATE (A)	CALCULATED DATE		A-B	A-B′
		ORIGINAL (B) (3)	MODIFIED (B′)		
1958	7/7	2/7	27/6	5	11
1959	NIL	17/8	16/8	-	-
1960	27/7	3/8	9/8	- 7	- 13
1961	31/7	25/7	7/8	6	- 7
1962	28/8	13/8	13/8	15	15
1963	18/7	22/7	30/7	- 4	- 12
1964	29/7	25/7	19/7	4	10
1965	18/7	27/7	25/7	- 9	- 7
1966	29/7	4/8	9/8	- 6	- 11
1967	16/8	16/8	18/8	0	- 2
1968	20/7	22/7	26/7	- 2	- 6
1969	12/8	2/8	6/8	10	6
1970	14/8	22/8	13/8	- 8	1
			Mean	+ 0.3	- 1.25
			SD	7.7	9.7

4. CONCLUSION

By simulating Graingers hypothesis of increasing sensitivity to blight with increasing Cp/Rs ratio the potato blight model does not show any improvement in predicting outbreak dates. This modification will therefore not be included in the operational version of the blight model.

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1. Grainger, J and A A Rutherford (1963) Rapid Determination of Host Receptivity in Potato Blight Forecasting, Europ. Potato J., vol. 6, pp 258-267

2. Sparks W R Blight: A Computer Model Relating the Progress of Potato Blight to Weather. Agricultural Memorandum 899

3. Sparks W R Weather and Potato Blight 1958-1980 (Unpublished)

Figure 1